CITIZEN
Micro HumanTech

Specifications

CONTROL BOARD

MODEL BD2-2220/2221

Rev. 1.00 Issued on October 10, 2006

CITIZEN SYSTEMS JAPAN CO.,LTD.

Revision

Rev.	Date	Comment
1.00	2006.10.10	Newly issued

CONTENTS

1. GENERAL OUTLINE

- This control board is used for controlling LT222X/232X through computer, etc.
- As it has a variety of functions, it can meet various kinds of applications.

* This specification applies only to control board BD2-2220/2221

* The information contained herein is subject to change without prior notice.

1.1 Features

1) Ultra-small design

2) High speed (150 mm/sec) printing

3) Applicable to the width of 80 mm (LT232X) and 58 mm (LT222X).

4) Built-in input buffer

5) Barcode printing (By special command)

6) Free printing layout by page mode

7) Registration of user-defined characters and logos into flash memory

8) Auto cutter control

9) No paper and paper near-end detection

10) Various kinds of functional selection by memory switch

11) Support JIS level 1 and level 2

12) User-defined characters are available. (94 characters)

13) Mounting hole position is the same as that of LT2X20.

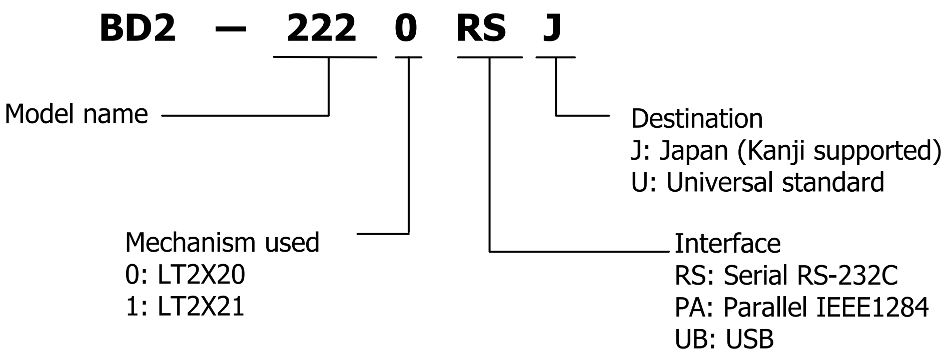
1.2 Accessories

After unpacking the product, make sure the following components are present.

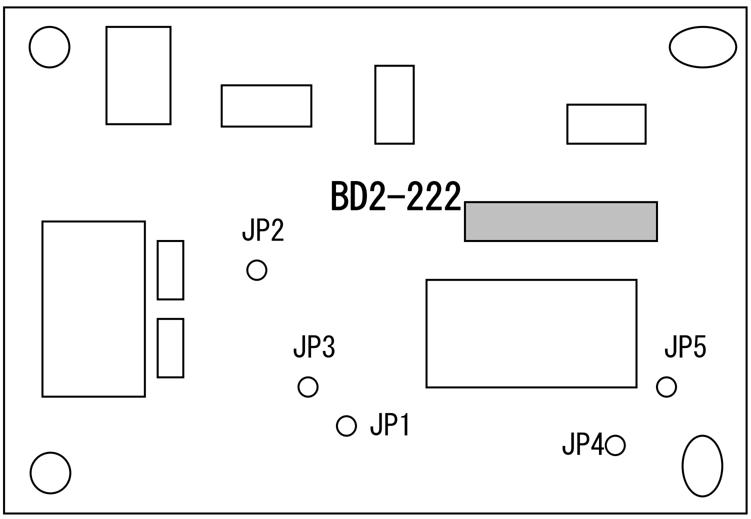
Control board ... 1
Interface cable ... 1 (A cable of 300 mm long)*
Mech FFC ... 1 (With 100-mm-long cable)

* Mini-USB cable is not supplied for USB model.

1.3 Model Classification



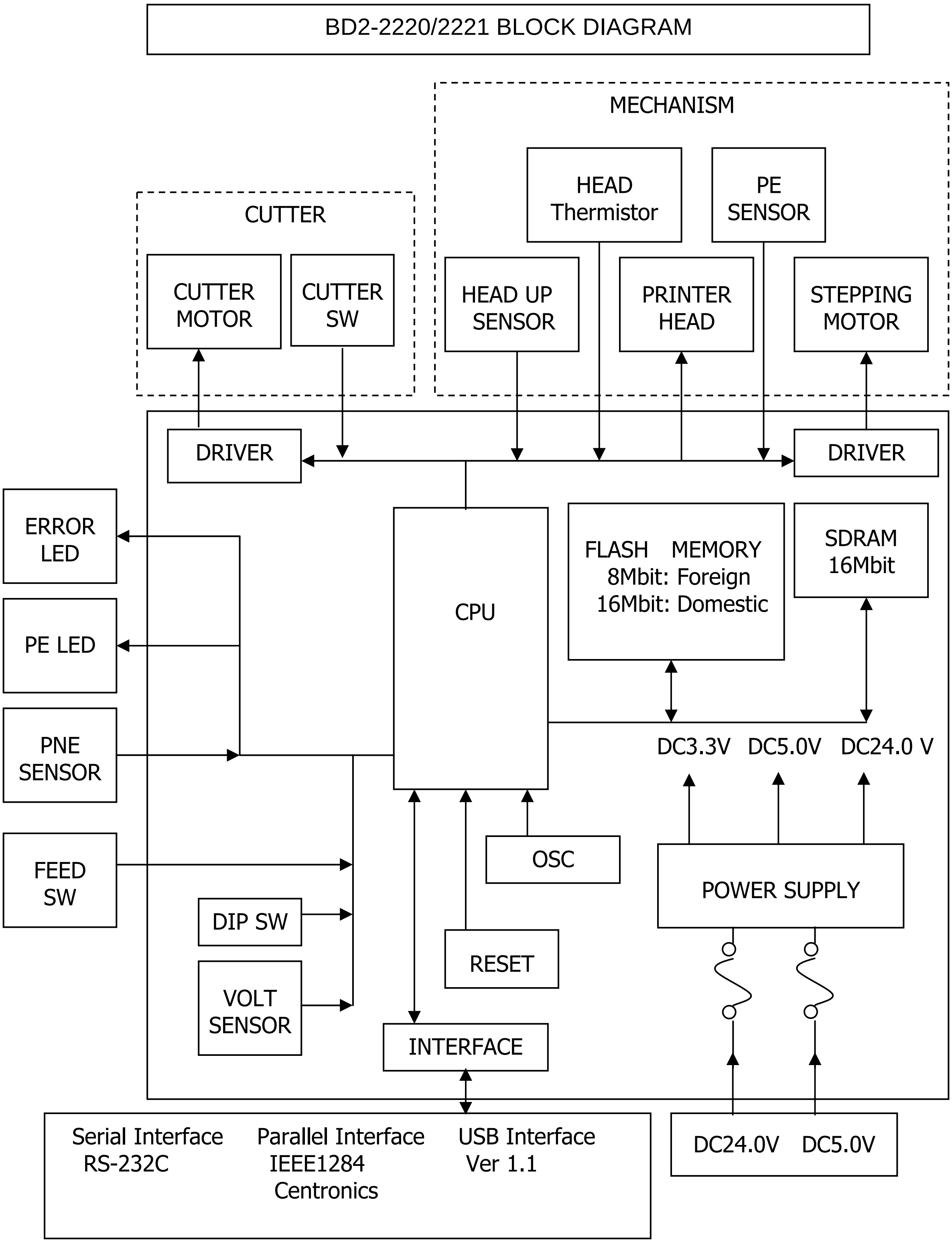
Control board model can be identified by the stamp on the jumper side of the control board. Stamped designation is shown below.



Model Name	Designation
BD2-2220RSJ	0RSJ
BD2-2220PAJ	0PAJ
BD2-2220UBJ	0UBJ
BD2-2220RSU	0RSU
BD2-2220PAU	0PAU
BD2-2220UBU	0UBU
BD2-2221RSJ	1RSJ
BD2-2221PAJ	1PAJ
BD2-2221UBJ	1UBJ
BD2-2221RSU	1RSU
BD2-2221PAU	1PAU
BD2-2221UBU	1UBU

Stamped designation:

1.4 Configuration (Block Diagram)



2. BASIC SPECIFICATIONS

2.1 Printing Specifications

1) Print method: Line thermal print method (Thermal printing system)

2) Dot configuration: LT222X: 432 dots/line, LT232X:576 dots/line

3) Dot density: 8 dots/mm (203 dpi)

4) Print area: LT222X: Max. 54 mm, LT232X: Max. 72 mm

5) Number of print columns:
LT222X: Max. 36 columns, LT232X: Max. 48 columns (12×24: Font A)
LT222X: Max. 48 columns, LT232X: Max. 64 columns (9×24: Font B)
LT222X: Max. 54 columns, LT232X: Max. 72 columns (8×16: Font C)
LT222X: Max. 18 columns, LT232X: Max. 24 columns (24×24: Kanji Font A)
LT222X: Max. 27 columns, LT232X: Max. 36 columns (16×16: Kanji Font C)

6) Character spacing: Selectable by use of command

7) Print speed: Max. 1200 dot-lines/sec (150 mm/sec)

8) Paper feed: Feed pitch: 0.125 mm

9) Line feed width: 4.23 mm (1/6 inch) settable by user

10) Print head: Line thermal print head

11) Emulation: ESC/POS compliant

Notes:
- The above printing speed is under the condition of 24.0 V, 25°C, printing duty of 12.5%.
- Print speed may be delayed depending on the setting of printing condition or combination of commands.

2.2 Character and Barcode Specifications

1) Character type

ANK characters: 96characters
Code pages: 128 characters × 12 pages
International characters: 12 characters × 14 countries
Japanese Kanji: JIS (JIS C6226-1983)
Non-kanji: 577 characters
JIS level 1: 2965 characters
JIS level 2: 3388 characters
(Only when destination is Japan)

2) Character size/configuration

Table 1 Character Size

	Standard	Double Height	Double Width	Double Height and Double Width
	W×H (mm)	W×H (mm)	W×H (mm)	W×H (mm)
Font A 12×24	1.5×3.0	1.5×6.0	3.0×3.0	3.0×6.0
Font B 9×24	1.13×3.0	1.13×6.0	2.26×3.0	2.26×6.0
Font C 8×16	1.0×2.0	1.0×4.0	2.0×2.0	2.0×4.0
Kanji A 24×24	3.0×3.0	3.0×6.0	6.0×3.0	6.0×6.0
Kanji C 16×16	2.0×2.0	2.0×4.0	4.0×2.0	4.0×4.0

Notes:
- Actual character may be smaller than the above as it includes space inside character font.
- Characters can be enlarged up to 8 times height and width in multiple steps of standard size.

3) Barcode

: UPC-A
: UPC-E
: JAN/EAN-8
: JAN/EAN-13
: ITF
: CODE39
: CODE93
: CODE128
: CODABAR (NW-7)

2.3 Print Paper Specifications (Thermal Paper)

1) Paper width : LT222X: 58 +0,-1mm, LT232X: 80 +0,-1mm

2) Paper thickness : 60μm ~ 150μm

3) Recommended paper

Nippon Paper Industries TF50-KS-E2D

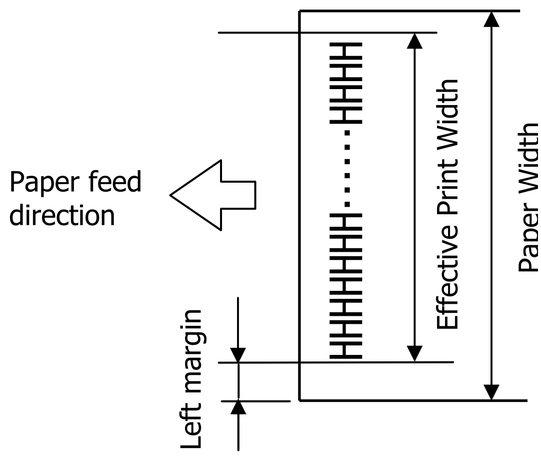
Mitsubishi Paper P220AC Or equivalent

Print density setting should be changed according to the type and thickness of paper. Change the density setting by the Customize value setting GS (E command. (See "7.3 Memory Switch".)

*When paper other than the specified, difference in print density may occur.
*Pay full attention to temperature, humidity, and environment when storing printed paper. Otherwise, the printed data may be lost.
*For the details of paper, refer to the specifications of each mechanism.

4) Effective print width (Print area)

Mechanism	Paper Width (mm)	Left Margin (mm)	Effective Print Width (mm)
LT222X	58+0,-1	2±2	54
LT232X	80+0,-1	4±2	72



5) Other

- Chromophoric surface: Roll outside
- Terminating process: Do not apply paste to fix the roll paper and core. Do not fold paper at the end of the paper.

2.4 Mechanism and Peripherals Used

The following mechanism and peripheral units can be connected to this control board.

1) Thermal mechanism
   58 mm Paper: LT222X
   80 mm Paper: LT232X

2) Auto cutter
   ACS-220/230 series

3) Paper near-end sensor (Option)

   * For the details of specification, etc., refer to the relevant manual.

2.5 Power Supply

2.5.1 Specifications

1) Operating voltage

   Driver power supply Vp:＋24.0 VDC ±5%
   Logic unit power supply Vdd:＋5.0 VDC ±5%
   :＋3.3 VDC ±5% (*+5.0 VDC internal conversion in board)

2) Current consumption

   Driver current Ip: Average current: Approx. 0.46 A (At ANK slide)
   Peak current: Approx. 4.9 A (At full dot printing)
   Logic unit current Idd: Average current: Approx. 230 mA (At ANK slide)
   Approx. 200 mA (At standby)

2.5.2 Precautions

1. When powering on, enter Vp within 100 ms after Vdd.

2. When powering off, turn Vdd after Vp.

3. Before connecting or disconnecting the connector, be sure to turn the printer power off.

4. Be sure to use Vdd and Vp within the specified range.

5. Be sure to use the printer by connecting both Vp and P-GND.

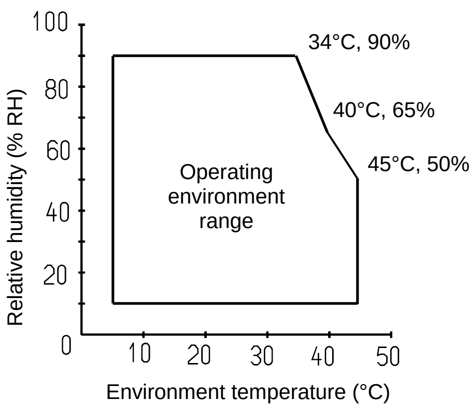
6. For the power supply at Vp side, use the power supply with peak current removed.

Cautions

- Using the power supply other than specified, bad effect may occur in printing operation, etc.
- Using the current without removing peak current may result in degradation of printing quality depending on the printing status or occurrence of low-voltage error.
- Use the power supply that can be turned off easily to prepare for emergencies.
- Power supply with overvoltage protection, overcurrent protection, and various protection circuits is recommended.
- This control board requires two different supply voltages. Use sufficient care not to make erroneous wiring or operation. Error in operation may not only break the control board but also have bad effect on human body or peripheral equipment.
- Though this control board has CN2 that has the same pin allocation as BD2-2880, it is different in supply voltage. Use sufficient care in handling this control board.

2.6 Environment: Temperature, Humidity

1) Operating
   Temperature: 5°C ~ 45°C
   Humidity: 10%RH ~ 90%RH (No dew condensation)



Relative humidity (%RH)
Operating environment range
Environment temperature (°C)

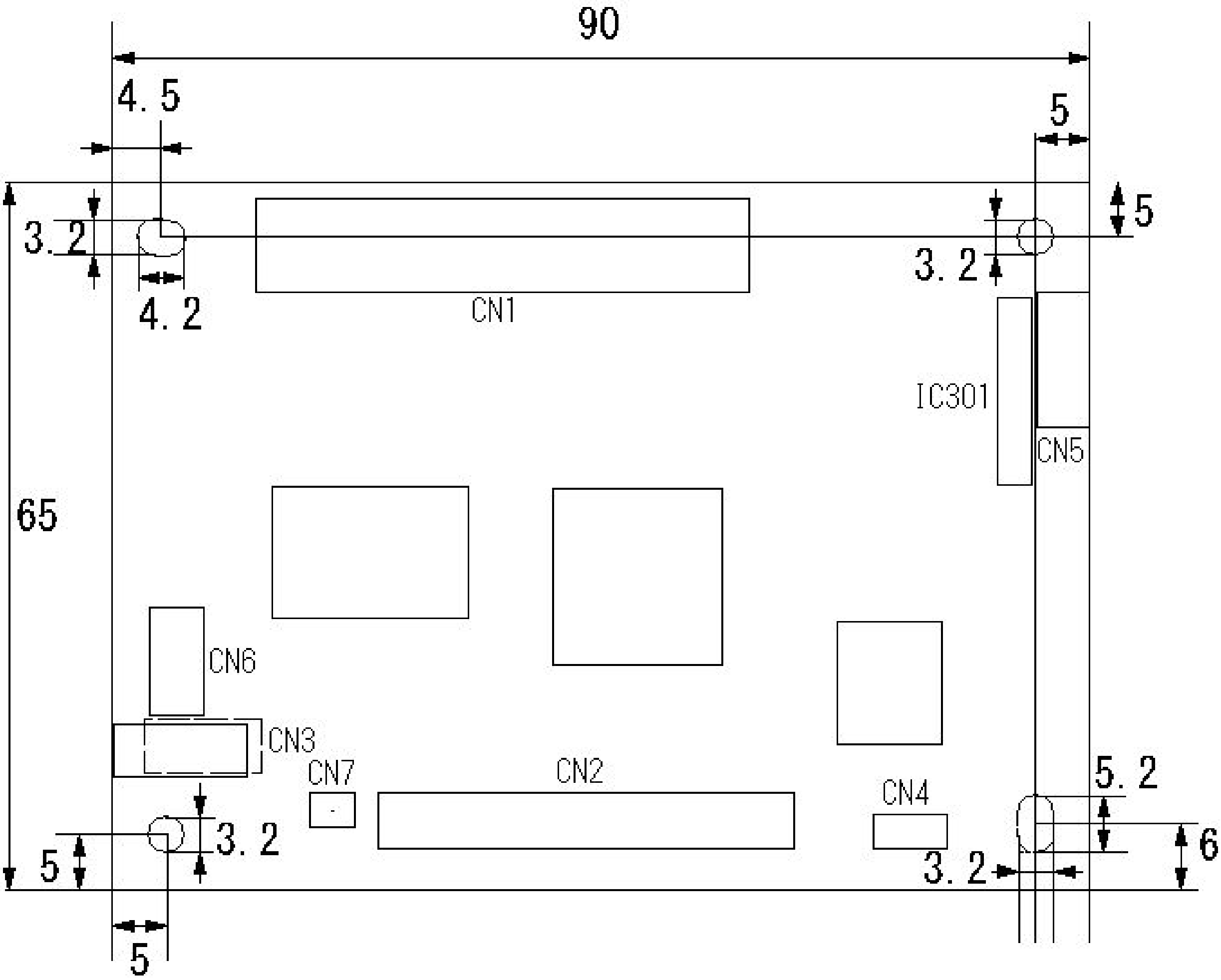
2) Storage (excluding roll paper)
   Temperature: −20°C ~ 60°C
   Humidity: 10% RH ~ 90% RH (No dew condensation)

   Note: For storage at high temperature, high humidity, the combination of 40°C, 90% RH (no condensation) shall be the worst value.

3. APPEARANCE SPECIFICATIONS

Weight : Approx. 37g (Only main body)

Dimensions Unit: mm



* Board size and screw hole position are common to all models.

4. Connector Connection

4.1 Interface Connectors

4.1.1 Interface Connector Pin Assignment (CN1)

Pin assignment

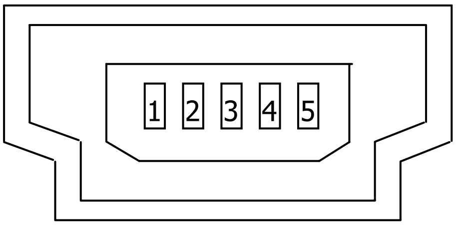
Pin	Signal Name			Input/Output			Function
	RS	PA	UB	RS	PA	UB	
1-2	Vdd			—			Circuit PS (+5V)
3-4	GND			—			Circuit GND
5-10	Vp			—			Drive PS (+24V)
11-16	P-GND			—			Drive GND
17	nFEED-SW			Input			FEED Switch (Paper feed)
18	nERROR			Output			ERROR output (directly connectable)
19	nPEOUT			Output			PE LED output (directly connectable)
20	DTR	N.C	N.C	Output	—	—	Serial interface DTR
21	TXD	N.C	—	Output	—	—	Serial interface TXD
22	RXD	N.C	—	Input	—	—	Serial interface RXD
23	DSR	N.C	—	Input	—	—	Serial interface DSR
24	N.C	DATA0	—	—	Input	—	Parallel interface DATA0
25	N.C	DATA1	—	—	Input	—	Parallel interface DATA1
26	N.C	DATA2	—	—	Input	—	Parallel interface DATA2
27	N.C	DATA3	—	—	Input	—	Parallel interface DATA3
28	N.C	DATA4	—	—	Input	—	Parallel interface DATA4
29	N.C	DATA5	—	—	Input	—	Parallel interface DATA5
30	N.C	DATA6	—	—	Input	—	Parallel interface DATA6
31	N.C	DATA7	—	—	Input	—	Parallel interface DATA7
32	N.C	nSTROBE	—	—	Input	—	Parallel interface nSTROBE
33	N.C	BUSY	—	—	Output	—	Parallel interface BUSY
34	N.C	nFAULT	—	—	Output	—	Parallel interface nFAULT
35	N.C	nSELECT	—	—	Output	—	Parallel interface nSELECT
36	N.C	PE	—	—	Output	—	Parallel interface PE
37	N.C	nACK	—	—	Output	—	Parallel interface nACK
38	N.C	nAUTOFD	—	—	Input	—	Parallel interface nAUTOFD
39	N.C	nSELECTIN	—	—	Input	—	Parallel interface nSELECTIN
40	N.C	nRESET	—	—	Input	—	Parallel interface nRESET

Connector used : RS PA 53313—4015 (Molex) UB 53313—2015 (Molex)
Cable supplied
- Housing : RS PA 51089—4005 (Molex) UB 51089—2005 (Molex)
- Terminal used : 50212 (Molex)
- Cable used : AWG26 (UL1007) or equivalent
- Cable length : 300mm (Cut at the end)

* Signal name beginning with "n" indicates Low active signal.

4.1.2 USB Interface Connector Pin Assignment (CN8) * Only USB model

Pin assignment



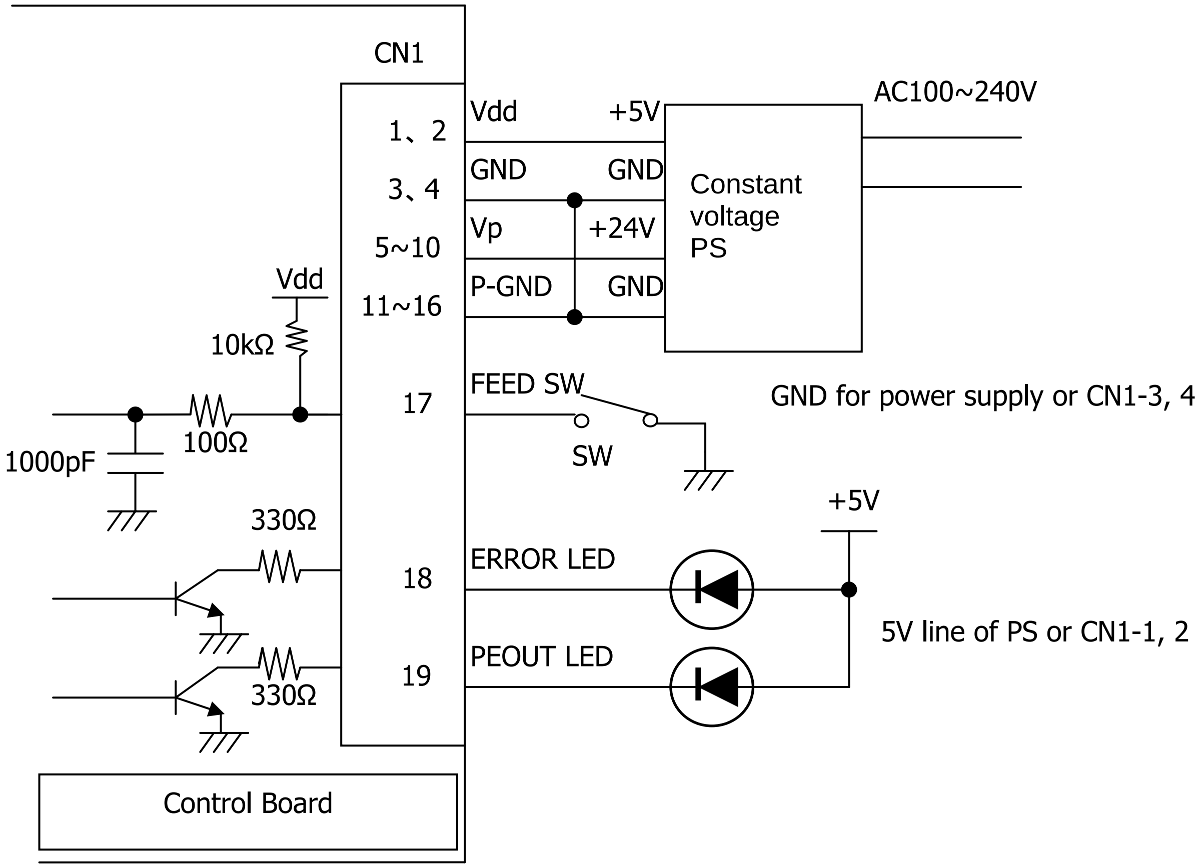
Series Min B plug

Pin	Signal Name	Input/Output	Function
1	VBus(+5V)	—	USB PS
2	-Data(D-)	Input/Output	USB D-
3	+Data(D+)	Input/Output	USB D+
4	N.C	—	Not connectable
5	GND	—	USB GND

* Do not use a cable of longer than 5 m.

4.1.3 CN1 Connection Example

* For each interface connection, refer to each item.



Notes:

1) As resistance 330Ω is inserted in the circuit so that current value of ERROR LED and PEOUT LED is 10 mA, use the LED with forward voltage of 2 V or so. Using LED exceeding 10 mA may break the control board.

2) Power supply for circuit (Vdd and GND) will operate if it is applied to only one pin. However, driving power supply (Vp and P-GND) shall be fed to all pins to retain current capacity.

3) Note that though a ceramic capacitor is provided in the circuit to prevent chattering, great chattering may occur depending on the switch. In this case, the user is requested to take an appropriate measure.

4) Do not conduct such operation that only paper feeding continues for more than 5 minutes. Excessive single operation of paper feed motor may cause failure. * In case of printing operation (12.5% coloring), continuous operation over 5 minutes causes no trouble.

5) The RESET terminal is pulled up with 3.3 kΩ at the circuit side. If it is not in use, it must be set as Non Connect.

6) Serial interface is equipped with RS-232C driver and receiver. Be sure to use in RS-232C level.

7) Unused pin shall be insulated so that cable end may not contact other terminal or part.

4.2 Mechanism Connector (CN2)

4.2.1 Mechanism Connector Pin Assignment (CN2)

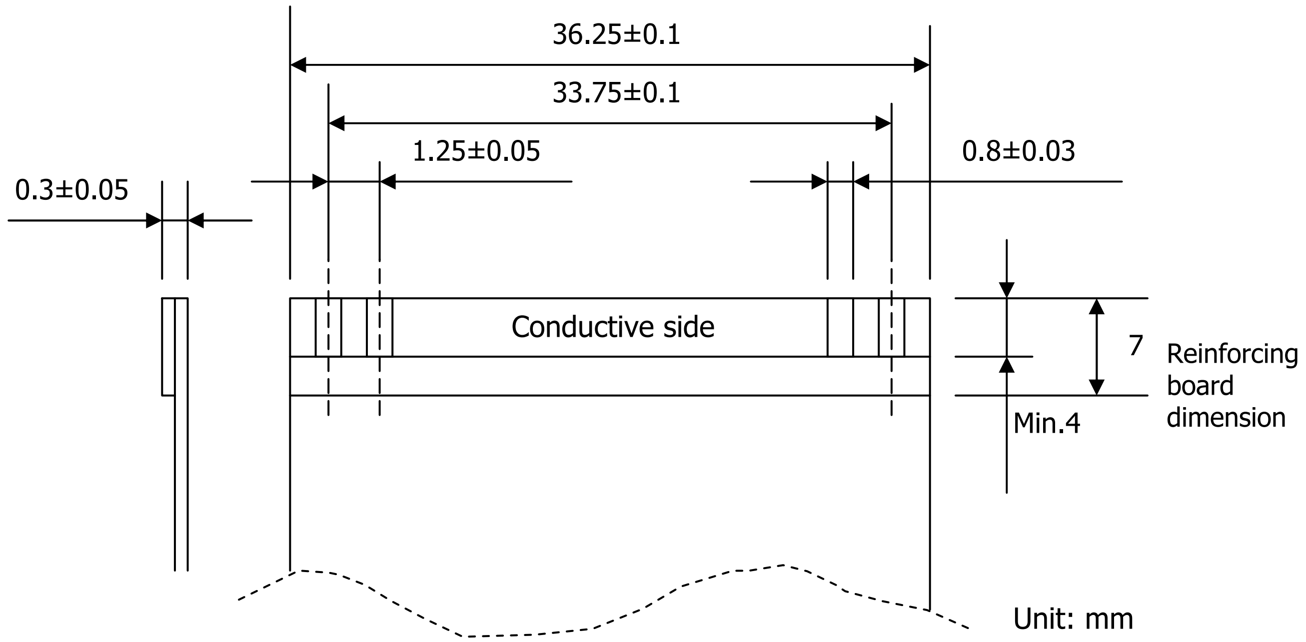
Pin assignment

Pin	Signal Name		Input/Output		Function	
	LT222X	LT232X	LT222X	LT232X	LT222X	LT232X
1 ~ 4	Vp		-		Thermal head PS	
5	N.C		-		N.C	
6	CLK		Output		Clock signal for data transmission	
7	LAT		Output		Print data latch signal	
8	N.C	STB2	-	Output	N.C	Strobe signal 2
9	STB1		Output		Strobe signal 1	
10	TM		-		Thermistor	
11 ~ 19	GND		-		GND	
20	TM		-		Thermistor	
21	Vdd		-		Thermal head driver PS	
22	STB3	STB4	Output		Strobe signal 3	Strobe signal 4
23	STB2	STB3	Output		Strobe signal 2	Strobe signal 3
24	DI		Output		Print data serial output	
25 ~ 28	Vp		-		Thermal head PS	

Connector used: 52045−2845 (Molex) or equivalent
52045−2845 (Molex)or equivalent

* Note that assignment of connector pins and control board pins is reversed.

4.2.2 FFC-compliant Cable



4.3 Head Up, Paper-End Detecting Connector (CN3, CN7)

Pin assignment

Pin		Sensor	Signal Name	Input/Output	Function
LT2X20	LT2X21				
CN3-1	-	Head Up sensor	HU-A	Output	
CN3-2	CN7-1		GND	—	
CN3-3	CN7-2		HU-C	Input	Head Up signal input
CN3-4	CN3-4	Paper sensor	PE-C	Output	
CN3-5	CN3-5		PE-K	Input	
CN3-6	CN3-6		PE-A	Output	
CN3-7	CN3-7		PE-E	Input	Paper-End signal input

Connector used LT2X20 CN3:52045—0745 (Molex) or equivalent
LT2X21 CN3:5597—04CPB (Molex) or equivalent
LT2X21 CN7:53047—0210 (Molex) or equivalent

* In case of LT2X21, 4-pin type is used for CN3 and CN7 is short-circuited by JP4. (Platen open sensor, if any, shall be removed.)

4.4 Motor Connector (CN4)

Pin assignment

Pin	Signal Name	Input/Output	Function
1	MOTOR A+	Output	Motor driving signal A+
2	MOTOR B-	Output	Motor driving signal B-
3	MOTOR A-	Output	Motor driving signal A-
4	MOTOR B+	Output	Motor driving signal B+

Connector used: 53047-0410 (Molex)

4.5 Auto Cutter Connector (CN5)

Pin assignment

Pin	Signal Name	Input/Output	Function
1	M+	Output	Cutter Motor driving signal M+
2	M-	Output	Cutter Motor driving signal M-
3	GND	—	GND
4	SW	Input	Cutter Switch input signal

Connector used: 5267-04A-X (Molex)

* Use dedicated cutter (ACS-220/230 series) for cutter.
* If cutter is not used, short the auto cutter feature of JP1.

4.6 Paper Near-End Sensor Connector (CN6) * Option

4.6.1 Paper Near-End Sensor Connector Pin Assignment (CN6)

Pin assignment

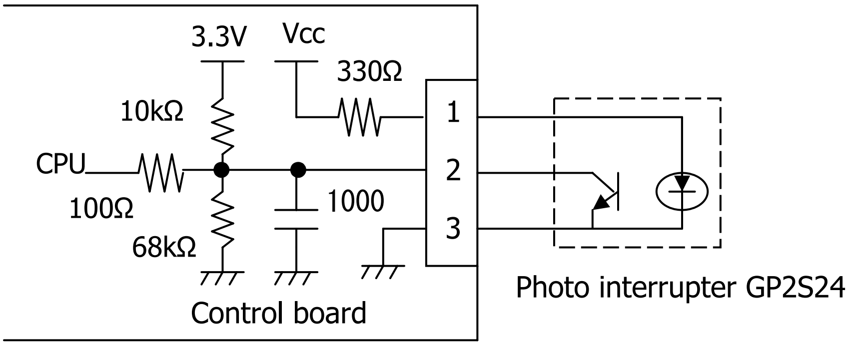
Pin	Signal Name	Input/Output	Function
1	PNE-A	Output	Photo interrupter anode
2	PNE-C	Input	Photo interrupter collector
3	GND	—	Photo interrupter cathode, emitter

Connector used: 5267-03A-X (Molex)

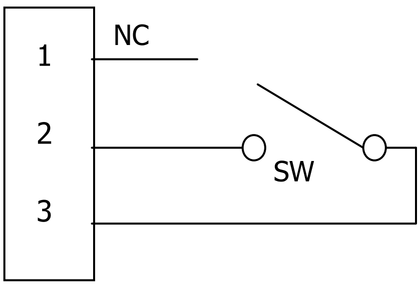
* At the time of shipment, pins 2 and 3 are short-circuited by JP5 and paper detection is disabled (always paper present is defined). In actual use, purchase the above connector.

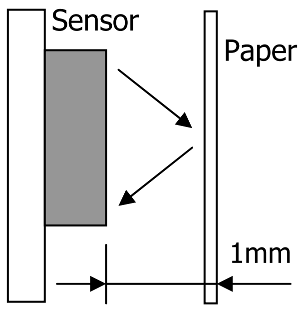
4.6.2 Reference Circuits

Photo interrupter is used.



Mechanical switch is used.





* In the above circuit, reflection type photo interrupter is taken as an example. With the above sensor, the clearance from paper must be about 1 mm. As electric characteristic varies with the sensor used, understand the sensor before use.
* Voltage detection range at the control board side (across 2 and 3) is.
  0 ~ 0.4V: Paper Present
  1V or more: No Paper
  This is not warranted in the state other than the above.

5. OPERATION PANEL

5.1 Output LED

1) PE LED
   ON : Paper-End detection
   OFF : Paper Present detection

2) ERROR LED
   ON : Head Up (LT2220/2320 is used), Platen Open (LT2221/2321 is used). Paper-End
   Blinking : Hex dump mode, memory switch setting mode, various errors, waiting for macro execution
   OFF : Normal operation

5.2 Details on Error and LED Indication

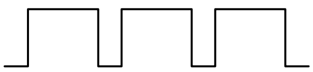
1) Error to recover automatically
   (1) Head overheat error

Explanation: For overheat protection, when the temperature of head increases (approx. 65°C or more), the printing is stopped and ERROR LED blinks.
When the temperature of head declines (approx. 60°C or less), the printing operation is started automatically.

PE LED: OFF

ERROR LED: Blinks with long illumination at ON

Restore Condition: Automatically restored by temperature decrease

PE LED	ERROR LED
OFF	
	Blinks with long illumination at ON

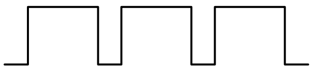
(2) Head Up error (LT2220/2320 is used and MSW3-8 OFF is set.)

Explanation: ERROR LED blinks during printing and when Head Up is set (with Head Up lever raised).

PE LED: OFF

ERROR LED: Blinks with long illumination at ON

Restore Condition: Set Head Down (with Head Up lever down).

PE LED	ERROR LED
OFF	
	Blinks with long illumination at ON

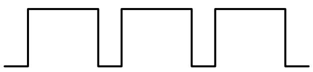
(3) Platen Open Error (LT2221/2321 is used and MSW3-8 OFF is set.)

Explanation: ERROR LED blinks during printing and when Platen Open is set (with Platen Open lever held down and platen retaining unit opened).

PE LED: OFF

ERROR LED: Blinks with long illumination at ON

Restore Condition: Close platen (close platen retaining unit and raise the Platen Open lever).

PE LED	ERROR LED
OFF	
	Blinks with long illumination at ON

2) Restorable error

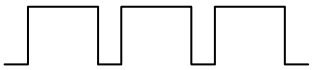
(1) Head Up error (LT2220/2320 is used and MSW3-8 ON is set.)

Explanation: ERROR LED blinks during printing and with Head Up.

PE LED: OFF

ERROR LED: Blinks with long illumination at ON

Restore Condition: After Head Down, clear the error by a command.
* For details of DLE ENQ 1, DLE ENQ 2, and DLE DC4 (fn=8), refer to Command Reference.

PE LED	ERROR LED
OFF	
	Blinks with long illumination at ON

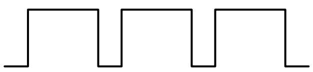
(2) Platen Open error (LT2221/2321 is used and MSW3-8 ON is set.)

Explanation: ERROR LED blinks during printing and when platen is opened.

PE LED: OFF

ERROR LED: Blinks with long illumination at ON

Restore Condition: After Platen Close, clear the error by a command.
* For details of DLE ENQ 1, DLE ENQ 2, and DLE DC4 (fn=8), refer to Command Reference.

PE LED	ERROR LED
OFF	
	Blinks with long illumination at ON

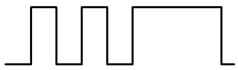
(3) Cutter lock error

Explanation: Cutter operation is disabled. Abnormality occurred.

PE LED: OFF

ERROR LED: ERROR LED repeats blinking 2 times fast and blinking 1 time slow.

Restore Condition: Remove the fault and restore by pressing the FEED switch (with MSW3-1 set to OFF) or by DLE EMQ 1 or 2 command (with MSW3-1 set to ON).

PE LED	**ERROR LED**
OFF	
	Repeats blinking 2 times fast and blinking 1 time slow.

3) Error impossible to restore

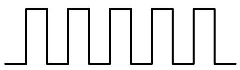
(1) Memory check error

Explanation: CPU self-diagnoses the circuit. When it detects abnormality in external RAM memory, ERROR LED blinks quickly.

PE LED: OFF

ERROR LED: Blinking quickly

Restore Condition: Irreparable
However, it can be restored by turning power OFF, replacing external RAM, and removing the cause of the abnormality.

PE LED	**ERROR LED**
OFF	
	ERROR LED blinks quickly.

(2) Low voltage error

Explanation: Occurs when the Vp voltage supplied to the printer is lowered.
If occurred, immediately turn the power OFF.

PE LED: OFF

ERROR LED: ERROR LED repeats blinking 3 times fast and blinking 1 time slow.

Restore Condition: Irreparable
However, it can be restored by turning the power OFF and then raising the Vp voltage to the range of DC 16.9 to 27.8 V.

PE LED	ERROR LED
OFF	
	Repeats blinking 3 times fast and blinking 1 time slow.

(3) High voltage error

Explanation: Occurs when the Vp voltage supplied to the printer is raised.
If occurred, immediately turn the power OFF.

PE LED: OFF

ERROR LED: ERROR LED repeats blinking 4 times fast and blinking 1 time slow.

Restore Condition: Irreparable
However, it can be restored by turning the power OFF and then raising the Vp voltage to the range of DC 16.9 to 27.8 V.

PE LED	ERROR LED
OFF	
	Repeats blinking 4 times fast and blinking 1 time slow.

4) Others

(1) Paper near-end

Explanation of status: When the diameter of the roll paper deceases to a certain degree (* differs with the status of using Near-End sensor), the Paper Near-End sensor responds and allows PE LED to light to indicate roll paper is low.

PE LED: ON

ERROR LED: OFF

Restore Condition: Set another paper roll.

PE LED	ERROR LED
ON	OFF

(2) Paper-end

Explanation of status: When roll paper becomes empty, the paper sensor in the paper path near the print head detects the paper end and causes PE LED and ERROR LED to light and the printing operation to stop.

PE LED: ON

ERROR LED: ON

Restore Condition: Set another paper roll.

PE LED	ERROR LED
ON	ON

(3) Head Up (when LT2220/2310 is used)

Explanation: When Head Up is set, ERROR LED lights.

PE LED: OFF

ERROR LED: ON

Restore Condition: Set Head Down.

PE LED	ERROR LED
OFF	ON

(3) Platen Open (when LT2221/2321 is used)

Explanation: When Platen is opened, ERROR LED lights.

PE LED: OFF

ERROR LED: ON

Restore Condition: Close Platen.

PE LED	ERROR LED
OFF	ON

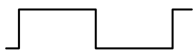
(4) Waiting for a macro execution

Explanation: The printer is waiting for a macro execution by ESC/POS's commands.

PE LED: OFF

ERROR LED: ERROR LED blinks slowly.

Restore Condition: Push the FEED SW.

PE LED	ERROR LED
OFF	
	Repeats blinking slow.

5.3 Feed Switch

Function

- When pressed once, paper feed of one line occurs based on the amount of line feed set by ESC 2 and ESC 3.

  However, paper feed is not available in the following cases.

  (1) When the FEED switch is set to disable by ESC c 5

  (2) When paper-end detector detected no paper

  (3) With Head Up. (LT2220/2310 is used)

  (4) With Platen Open (LT2221/2321 is used)

  (5) When error occurred

  (6) When waiting for macro execution (execution of macro by the FEED switch), pressing the FEED switch causes the macro to be executed.

- At the time of Cutter Lock error, pressing the FEED switch after removing the cause clears the error. (Depending on the status of MSW3-1)

5.3.1 Self-printing

1) Function

Function to enable the printer setting status to be verified by printing

2) Start of self-printing

When the power is turned on with the FEED switch pressed and held in print ready state, printer status is printed on the roll paper.

Explanation of printed item is as shown below.

(1) Printer type name BD2-2220
(2) ROM version VX.XXXXXX
(3) Mechanism used
(4) Interface setting
(5) Buffer size
(6) Content of DIP switch setting (Only serial interface)
(7) Jumper settings (Only JP1 to 3. JP4, 5 are not printed.)
(8) Content of memory switch
(9) Font A (20H ~ FFH)
(10) Font B (20H ~ FFH)
(11) Font C(20H ~ FFH)
(12) Kanji Font A 192 characters (Only Kanji specification)
(13) Kanji Font C 192 characters (Only Kanji specification)
(14) Line is fed up to cut position.

3) End of self-printing

Print a specified print pattern and perform resetting after printing for initialization.

5.3.2 Hexadecimal Dump Printing

1) Function

Prints the data sent from the host in hexadecimal code and the corresponding characters.

2) Starting hexadecimal dump

With paper set and Head Up (or Platen Open), turn the power on while pressing and holding the FEED switch. Set Head Down (or Platen Close). Then "HEX dump print mode" is printed on the roll paper followed by the printing of data received thereafter in hexadecimal numbers and corresponding characters.

Example: When dump printing is executed in Kanji mode.

```
HEXダンプ印字モード
1B 40 31 32 33 34 35 36 .@123456
37 38 39 30 0A          7890.

            Completed
```

Example: When dump printing is executed in non-Kanji mode.

```
HEX DUMP PRINT MODE
1B 40 31 32 33 34 35 36 .@123456
37 38 39 30 0A          7890.

            Completed
```

- During hexadecimal dump, command other than Real time command has no function.
- When print data is less than one line, offline factor occurs to print the line.

3) End of hexadecimal dump

- Press the FEED switch consecutively three times. In this case "Completed" is printed and paper is fed to the cut position and then a reset occurs. Otherwise, turn the power OFF or perform a reset by the I/F signal.

5.3.3 Memory Switch Setting Mode

1) Settable memory switch
MSW1、MSW2、MSW3

2) Starting memory switch setting mode
With paper set and Head Up (or Platen Open), turn the power on while pressing and holding the FEED switch and then press the FEED switch twice, set Head Down (or Platen Close) to start the setting mode.
After the setting mode is started, the guidance of setting content and operation method is printed.

3) Selecting memory switch
By pressing FEED SW shortly (less than 500 ms), the memory switches to be set is selected in the following order.
In doing so, the status of selected memory switch is printed. However, when ④ is selected, the verification of flash memory writing is printed.
(1) MSW1
(2) MSW2
(3) MSW3
(4) Recording / Initialization of the setting

* By pressing the FEED switch long (2s or more) when ① to ③ is selected, setting the selected memory switch is started. (Goes to the following 4) Setting memory switch.)

* By pressing the FEED switch long when (4) is selected, current memory switch settings are all written into the flash memory and Reset operation is carried out. (Goes to the following 5) Terminating memory switch setting mode.)

By pressing the FEED switch long with Head Up (or Platen Open) when (4) is selected, a reset operation is executed with current memory switch settings discarded and factory setting restored. (Goes to the following 5) Terminating memory switch setting mode.)

4) Setting memory switch

(1) Print the status of bit which is currently set.
(2) Pressing the FEED switch short (less than 500 ms) causes the selected bit to be inverted. Here, if the bit is ON, error LED lights.

(3) Pressing the FEED switch long (more than 2s) causes current bit to be saved. If any change occurs, the status of the bit is printed.

Setting the following bits is started.
The order of change of bit is shown below.

Bit 0 → Bit 1 →...→ Bit 6 → Bit 7 → Bit 0 →...

(4) The setting is terminated with Head Up (or Platen Open). Then by Head Down, current status of memory switch is printed and returns to 3) Selecting memory switch.

5) Terminating memory switch setting mode
After setting, the settings are saved and initializing operation (Reset) is carried out and normal printable condition is restored.

6. INTERFACES

6.1 Bidirectional Parallel Interface (IEEE1284)

6.1.1 Specification

1) Compatibility Mode (Host → Printer Communication: Centronics Compliant)

(1) Outline
Compatibility Mode is a standard of Centronics interface that has been used for long.

(2) Specification

Data transfer system: 8 bit parallel
Synchronization: By the nStrobe signal supplied from outside
Handshake: By the nAck signal and Busy signal
Signal level: All signals are TTL compatible.

2) Reverse Mode (Printer → Host Communication)
Transfer of status data from this printer to the host is made in the Nibble or Byte Mode.

(1) Outline

This mode specifies the data transfer from the asynchronous printer controlled by the host.

Data transfer in the Nibble Mode is carried out through existing control line and data is transferred in steps of 4 bits (Nibble).

In the Byte Mode, data is transferred through the 8-bit data line treated for bidirectional transmission.

In any case, as concurrent execution with Compatibility Mode is not available, communication is made in half duplex mode.

When using this mode, use CN1-38 and 39 pins in addition to the parallel interface terminal of the interface cable.
CN1-38 pin: nAUTOFD
CN1-39 pin: nSELECTIN
Unless these two pins are used, bidirectional communication cannot be implemented. If you don't want to use bidirectional communication, set the terminal to be Non Connect.

* The first "n" of a signal name indicates "LOW" active signal. If any one of the above signals is missing, bidirectional communication is impossible. Always use twisted pair line for signal lines of interface while connecting the return side to the signal ground level. All the interface conditions shall be based on C-MOS level and satisfy the following characteristics. Rising and falling time of each signal shall be 0.5 μs. Never carry out data transfer by ignoring the nAck signal or Busy signal. Otherwise, data transfer may result in loss of data. Interface cable shall be minimum necessary length.

6.1.2 Description of Input/Output Signals

1) Input/Output Signals
Explanation of input/output signals

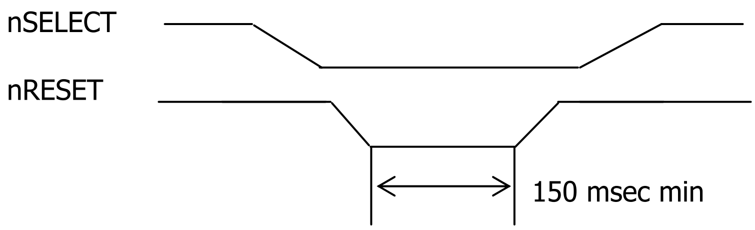
[1] Input/Output Signals (Compatibility Mode)

(1) Input signals to the printer

- DATA0 ~ 7: 8 bit parallel signal (positive logic)

- nSTROBE: Strobe signal for reading out 8-bit data (negative logic)

- nRESET: Applies reset by the nRESET signal in Compatibility Mode.
(Can be disabled by the setting:Msw3-3)
Reset signal is invalid for nSelectIn/1284-Active "HIGH".



- nSELECTIN : Signal to set "HIGH" when transferring to the IEEE 1284 mode (negative logic)

(2) Output signals from the printer

- nACK: 8-bit data request signal (negative logic)

- BUSY: Signal to indicate the printer is in the Busy state.

State to become BUSY

1. Period from Reset (including reset by NV memory write command, I/F signal, and test print command) or just after printer power on to printer operation ready state.
2. Under test printing
3. Input buffer full state (Refer to "(4) Buffer full state".)
4. During Head Up (or Platen Open)
5. Under line feeding with FEED switch
6. Waiting for pressing FEED switch at the execution of macro
7. No paper state
8. Error state

BUSY regardless of memory SW setting under the above 1 to 3 conditions.
Does not become BUSY in other case as specified by setting.

・SELECT: Always non-active ("LOW").

・nFAULT: Signal to set "LOW" when the printer is in the error state (negative logic).

・PE: Signal to be output with No paper or near-end state (by command setting) (positive logic)

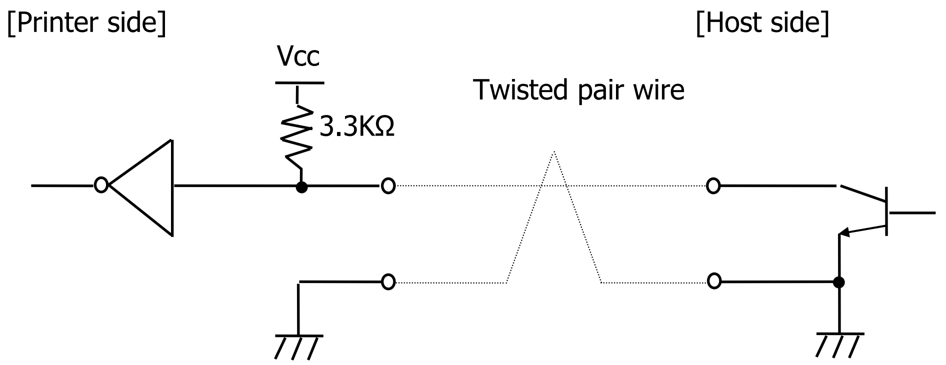
Note: When using a command followed by FROM writing, printer may temporarily become BUSY (DTR) at the time of write operation. In this case, as the printer cannot make any processing, data transmitted may possibly be discarded.

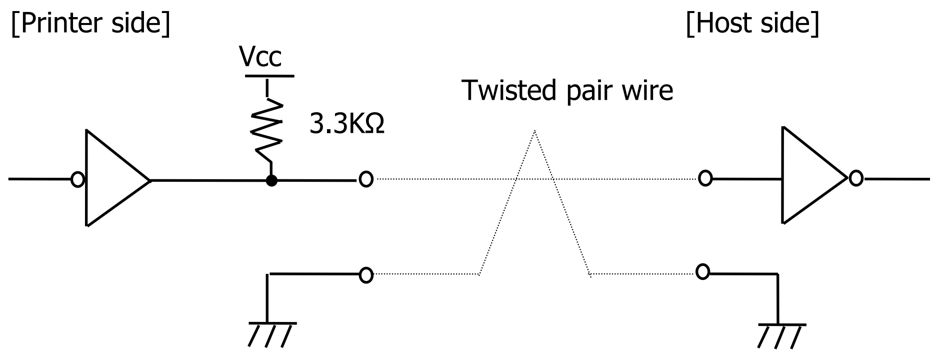
2) Electrical Characteristics

[1] Input signal level (nStrobe, Data0 ~ 7)
All input signals are C-MOS level.
"HIGH " level: 2.0V min.
"LOW " level: 0.8V max.

[2] Output signal level
All output signals are C-MOS level.
"HIGH " level: 4.4V min.
"LOW " level: 0.1V max.

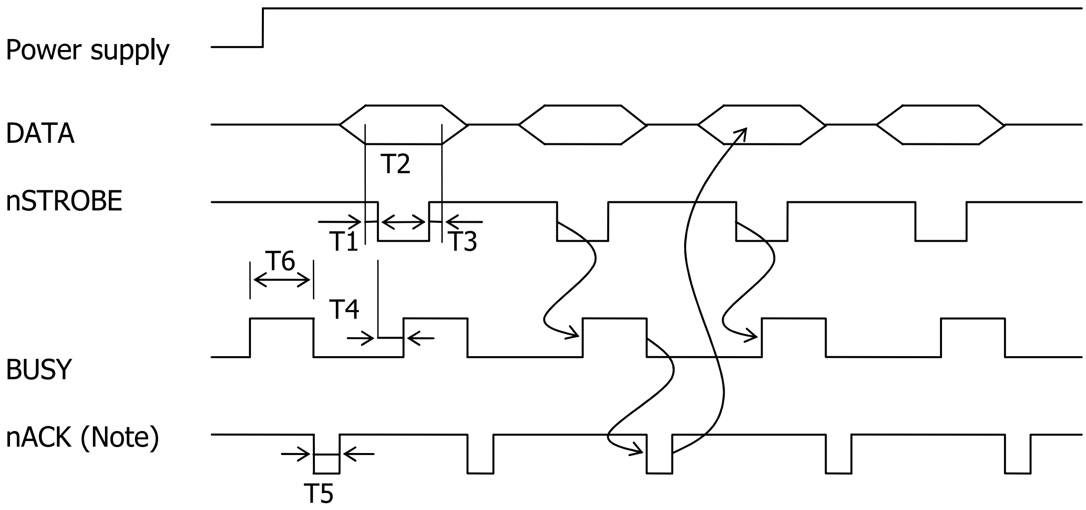
[3] I/O conditions
All input/output signals are pulled up with 3.3 kΩ.





3) Timing chart (Compatibility Mode)

Data input and print timing



T1, T2, T3 : 0.5 μs MIN
T4 : 270ns MAX
T5 : 2.3 μs TYP
T6 : 1200ms MIN (At power on)

Figure Timing Chart

Note: ACK output position can be changed to ACK in BUSY, ACK while BUSY, or ACK after BUSY by the setting of customize value.

4) Buffer full state

Buffer full state is when the remaining capacity of input buffer is as shown below.

Table Input Buffer Full

Set Value	Buffer Full	Clear
4K bytes	Remaining 128 bytes	Remaining 256 bytes
45 bytes	Remaining 16 bytes	Remaining 26 bytes

・When the remaining capacity of input buffer is 0 byte, data received is read and discarded.

5) Reverse Mode (Nibble/Byte) mode allows status to be transmitted from the printer.
(Using GS a, DLE EOT n, GS r, of GS I command)

- The transmitting buffer of the printer is 99 bytes. The host must transfer to Reverse Mode to prevent loss of status. Being in the Reverse Idle state is desired when using ASB. If this is not possible, always monitor the presence or absence of the transmitting data from the printer. The ASB not transmitted but accumulated is transmitted together (OR) with the latest status.

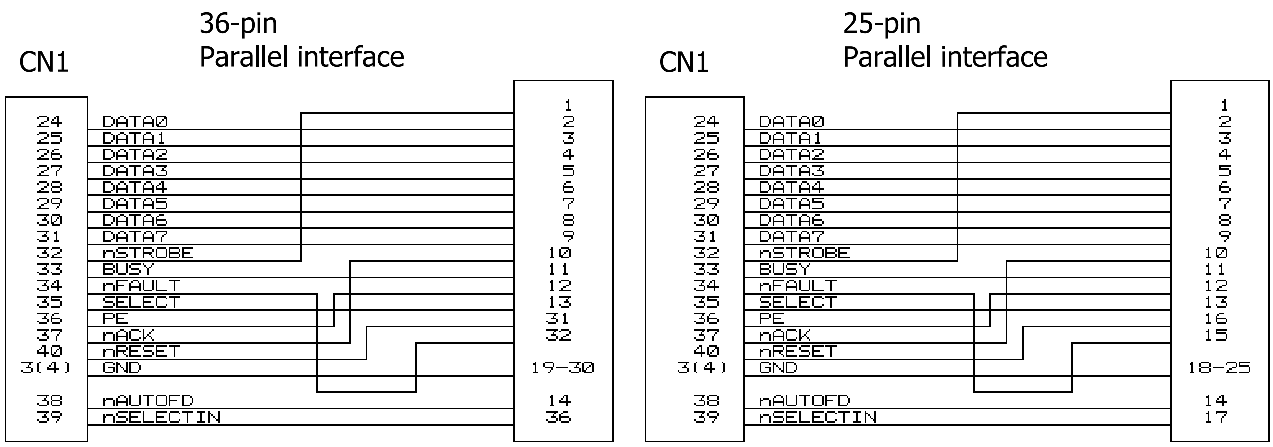
- Identification of information on each status is available.

Identification of Status

Command, Code	Status
GS I	＜0**0****＞B
GS r	＜0**0****＞B
XON	＜00010001＞B
XOFF	＜00010011＞B
DLE EOT	＜0**1**10＞B
ASB (1st byte)	＜0**1**00＞B
ASB (2nd byte)	＜0**0****＞B

6.1.3 Connection to Parallel Port

1) Connection to 36-pin/25-pin parallel port



2) Connection to other parallel port
To connect to the connector other than the above, verify the status of various signals and connect properly.

6.2 RS-232C Serial Interface

6.2.1 Specification

1) Synchronization: Asynchronous

2) Baud rate
   2400, 4800, 9600, 19200, 38400, 57600, 115200 bps (User selection)

3) Word configuration
   Start bit: 1 bit
   Data bit: 7 bits or 8 bits (User selection)
   Parity bit: Odd, even, or no parity (User selection)
   Stop bit: 1 bit or more

4) Signal polarity
   RS-232C
   - Mark ＝Logic ”1” (-3V to-12V)
   - Space ＝Logic ”0” (+3V to +12V)

6.2.2 Description of Input/Output Signals

1) Input/Output Signals

(1) RD
Receive Data

When the host is connected, the unstable TD signal that can occur at the rise (fall) of host power is defined as a break signal and the data is read and discarded.

(When the host power is turned off, the host may cause unstable state in TD. Printing of such data shall be avoided.)

(2) TD
Transmit Data

(3) DSR
When DTR/DSR control is selected, data is transmitted after confirming that this signal is a space.

When XON/XOFF control is selected, data is transmitted by ignoring DSR.

(4) DTR
Space sets the printer is in the Busy state and mark sets the printer in the Ready state.

Condition to become Busy can be switched by the setting (MSW1-3).

・State to become BUSY

1. Period from Reset (including reset by NV memory write command, I/F signal, and test print command) or just after printer power on to printer operation ready state.

2. Under test printing

3. Input buffer full state (Refer to "(2) Buffer full state".)

4. During Head Up (or Platen Open)

5. Under line feeding with FEED switch

6. Waiting for pressing FEED switch at the execution of macro

7. No paper state

8. Error state

BUSY regardless of memory SW setting under the above 1 to 3 conditions. Does not become BUSY in other case as specified by setting.

Note: When XON/XOFF control is selected, mark state occurs only in the state of 1 and 2. In other case, space state is set. Used to know the status of connection between the printer and host.
The state other than item 3 is defined as offline.

XON/XOFF output condition

・XON transmission

1. Period from Reset (including reset by NV memory write command, I/F signal, and test print command) or just after printer power on to printer operation ready state.

2. When input buffer full state is cleared. Does not output if the printer is offline even memory switch setting is OFF.

3. When the printer changed from offline to online. Does not output in buffer full state.

・XOFF transmission

1. When input buffer becomes buffer full state.

2. When the printer changed from online to offline. Does not output in buffer full state.

2) Buffer full state

Buffer full state is when the remaining capacity of input buffer is as shown below.

Table Input Buffer Full

Set Value	Buffer Full	Clear
4K bytes	Remaining 128 bytes	Remaining 256 bytes
45 bytes	Remaining 16 bytes	Remaining 26 bytes

- When the remaining capacity of input buffer is 0 byte, data received is read and discarded.

3) Data receive error

When any of the following error occurs, data is printed as "?" or read and discarded (Msw1-4).

- Parity error
- Framing error
- Overrun error

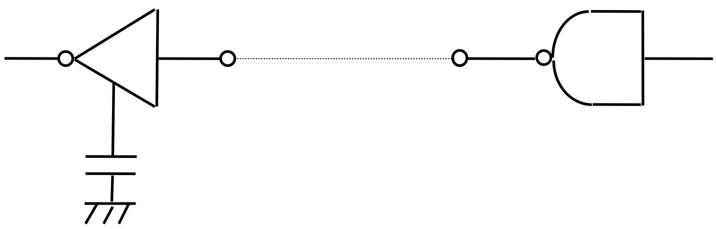
Note: When a command accompanying flash ROM write is used, the printer may become BUSY (DTR) temporarily at write operation. In this case, as the printer cannot process anything, the transmitted data may possibly be discarded.

4) Electrical Characteristics

[1]RS-232C circuit (MAX 232 or equivalent)

Input (RD, DSR)

[Printer side] [Host side]

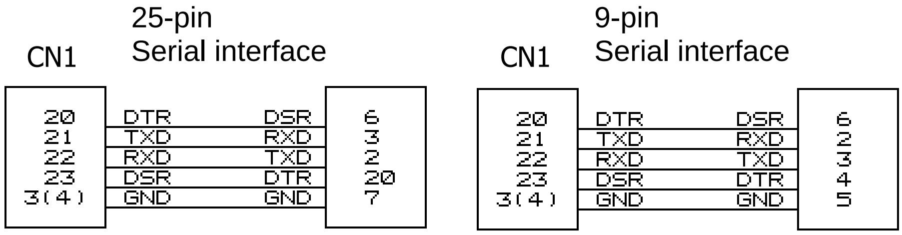


Output (DTR, TD)



6.2.3 Connection to Serial Port

1) Connection to 25-pin/9-pin serial port



*The above wiring is an example of standard connection to the host. If the cable is relayed, it is necessary to take such measures as connecting DTR/DSR and RXD/TXD reversely, etc.

2) Connection to other serial port
To connect to the connector other than the above, verify the status of various signals and connect properly.

6.3 USB Interface

(1)Whole specification: Based on the specification of USB1.1

(2)Communication speed: USB full-speed mode (12 MHz)

(3)Communication method: USB bulk forwarding method

(4)Power supply: 0 mA (Power is supplied from the printer.)

7. Function Selection

When using this control board, some functions can be set to default.

7.1 Jumper

Turn the printer power off before changing jumper setting.

Jumper No.	Function	Open	Short
JP1	Auto cutter	Enable	●Disable
JP2	Mechanism used	●LT2220/2221	LT2320/2331
JP3	Auto loading	●Enable	Disable
JP4*	Platen Open sensor	●Enable	Disable
JP5	PNE sensor	Enable	●Disable

* Disabled (Short) for BD2-2221.
●Default (factory setting)

7.2 DIP switch (Only Serial Interface)

DIP switch is located on the RS-232C serial interface board.
Change the DIP switch setting with power set to OFF.

Switch No.	Function	ON	OFF
1	Communication condition setting method	● Depend on DIP switch setting	Depend on customer's value setting.
2	Handshake	XON／XOFF	● DTR／DSR
3	Bit length	7 bits	● 8 bits
4	Parity check	With parity	● None
5	Parity selection	Even parity	● Odd parity
6	Baud rate selection	See "Selecting Baud Rate" below.	
7			
8	Reserved	―	● Fixed

● Default (factory setting)

Selecting Baud Rate

Switch No. / Baud Rate (bps)	6	7
2400	OFF	OFF
4800	ON	OFF
9600	● OFF	● ON
19200	ON	ON

● Default (factory setting)

Baud rate (38400, 57600, 115200 bps) other than the above can be set by command.

7.3 Memory Switches

Memory switch is a generic name for the following:
Memory switches MSW1, MSW2, and MSW3
Customize value
Serial Interface Communication Conditions

1) Memory switches MSW1, MSW2, and MSW3

Memory switch setting table

No.	Function	OFF	ON
MSW1-1	Power ON notice setting	● Enable	Disable
MSW1-2	Input buffer	● 4K bytes	45 bytes
MSW1-3	Busy condition	● Full/Off line	Buffer full
MSW1-4	Receive error character	● Character “?”	Disable
MSW1-5	CR mode	● Disable	Enable
MSW1-6	Reserved	● Fixed	—
MSW1-7	DSR signal selection	● Disable	Enable
MSW1-8	Reserved	● Fixed	—
MSW2-1	Reserved	—	● Fixed
MSW2-2	Reserved	—	● Fixed
MSW2-3	Buffering	● Disable	Enable
MSW2-4	Full digit printing	● Line feed	WaitData
MSW2-5	Head Down restore *	● Next	Top
MSW2-6	Reserved	—	● Fixed
MSW2-7	Reserved	● Fixed	—
MSW2-8	Reserved	● Fixed	—
MSW3-1	Auto Cutter recovery	● L/F Enable	L/F Disable
MSW3-2	Reserved	● Fixed	—
MSW3-3	Parallel Reset	● Reset	Ignored
MSW3-4	Reserved	● Fixed	—
MSW3-5	Reserved	● Fixed	—
MSW3-6	Reserved	● Fixed	—
MSW3-7	Reserved	● Fixed	—
MSW3-8	Head Up in printing *	● Automatic recovery	Recoverable error

● Default (factory setting)
* When LT2221/2321 is used, function for Platen Close/Platen Open is applied.

2) Customize value

Customize value can be set by the GS (E command.

Function	Value	
Specify the user NV memory capacity	1K bytes	64K bytes
	128K bytes	● 192K bytes
Select the print density	70%	75%
	80%	85%
	90%	95%
	● 100%	105%
	110%	115%
	120%	125%
	130%	—
ACK output position (Verification required)	ACK-in-Busy	● ACK-while-Busy
	ACK-after-Busy	—
At Input Buffer Full, BUSY output timing (Verification required)	● 1	2
	3	4

● Default (factory setting)

3) Serial interface communication conditions

Communication conditions can be set by the GS(E command.

Function	Value	
Baud rate	2400 bps	4800 bps
	● 9600 bps	19200 bps
	38400 bps	57600 bps
	115200 bps	—
Parity	● None	Odd
	Even	—
Flow control	● DSR/DTR control	XON/XOFF control
Data length	7-bit length	● 8-bit length

● Default (factory setting)

8. PRINT CONTROL COMMANDS

○ Print Control Commands

Control Command	Function	Mode	GS P
LF	Printing and paper feed	S・P	
CR	Back to printing	S・P	
FF	Printing in page mode and recovery	P	
ESC FF	Printing data in PAGE MODE	P	
ESC J	Printing and feeding paper in minimum pitch	S・P	○
ESC d	Printing and feeding the paper by "n" lines	S・P	

○ Print Character Commands

Control Command	Function	Mode	GS P
CAN	Canceling print data in PAGE MODE	P	
ESC SP	Setting the right spacing of the character	S・P	○
ESC !	Collectively specifying the printing mode	S・P	
ESC %	Specifying/canceling download character set	S・P	
ESC &	Defining the download characters	S・P	
ESC -	Specifying/canceling underline	S・P	
ESC ?	Deleting download characters	S・P	
ESC E	Specifying/canceling emphasis printing	S・P	
ESC G	Specifying/canceling double strike printing	S・P	
ESC M	Selection of character fonts	S・P	
ESC R	Selecting the international character set	S・P	
ESC V	Specifying/canceling 90°-right-turned characters	S	
ESC t	Selecting the character code table	S・P	
ESC {	Specifying/canceling the inverted characters	S	
GS !	Specifying the character size	S・P	
GS B	Specifying/canceling the black/white inverted printing	S・P	
GS b	Specifying/canceling the smoothing	S・P	

○ Print Position Commands

Control Command	Function	Mode	GS P
HT	Horizontal tab	S・P	
ESC $	Specifying the absolute positions	S・P	○
ESC D	Setting horizontal tab position	S・P	
ESC T	Selecting the character printing direction in PAGE MODE	P	
ESC W	Defining the print area in PAGE MODE	P	○
ESC ＼	Specifying the relative position	S・P	○
ESC a	Aligning the characters	S	
GS $	Specifying the absolute vertical position of characters in PAGE MODE	P	○
GS L	Setting the left margin	S	○
GS W	Setting the print area width	S・P	○
GS ＼	Specifying the relative vertical position of a character in PAGE MODE	S・P	○

○ **Line Feed Span Commands**

Control Command	Function	Mode	GS P
ESC 2	Specifying 1/6-inch line feed rate	S・P	
ESC 3	Setting line feed rate of minimum pitch	S・P	○

○ **Bit Image Commands**

Control Command	Function	Mode	GS P
ESC *	Specifying the bit image mode	S・P	
GS *	Defining the download bit image	S・P	
GS /	Printing the downloaded bit image	S・P	
GS v 0	Printing of raster bit image	S	

○ **Status Commands**

Control Command	Function	Mode	GS P
DLE EOT	Sending status in real-time	S・P	
GS a	Enabling/disabling ASB (Automatic Status Back)	S・P	
GS r	Sending status	S・P	

○ **Paper Detecting Commands**

Control Command	Function	Mode	GS P
ESC c 3	Selecting the Paper Sensor valid for Paper-end signal output	S・P	
ESC c 4	Selecting the Paper Near-end Sensor valid for print stop	S・P	

○ **Panel Switch Commands**

Control Command	Function	Mode	GS P
ESC c 5	Enabling/disabling the panel switches	S・P	

○ **Macro Commands**

Control Command	Function	Mode	GS P
GS :	Starting/ending macro definition	S・P	
GS ^	Executing the macro	S・P	

○ **Cutter Commands**

Control Command	Function	Mode	GS P
ESC i	Cutting the paper partially	S・P	
ESC m	Cutting the paper partially	S・P	
GS V	Cutting the paper	S・P	○

○ Bar Code Commands

Control Command	Function	Mode	GS P
GS H	Selecting of printing position of HRI characters	S･P	
GS f	Selecting the font of HRI characters	S･P	
GS h	Specifying the height of the bar code	S･P	
GS k	Printing the bar code	S･P	
GS w	Specifying the horizontal size (magnification) of bar code	S･P	

○ Commands for Flash Memory

Control Command	Function	Mode	GS P
FS p	Printing the bit image in flash memory	S	
FS q	Defining the bit image in flash memory	S	

○ Printer Setting Commands

Control Command	Function	Mode	GS P
GS (E	User-defined command	S	
GS (K	Selecting print control method	S	
GS (M	Customizing the printer	S	

○ Other Commands

Control Command	Function	Mode	GS P
DLE ENQ	Real-time request to printer	S･P	
DLE DC4	Clearing buffer	S･P	
ESC =	Data input control	S･P	
ESC @	Initializing the printer	S･P	
ESC L	Selecting PAGE MODE	S	
ESC S	Selecting STANDARD MODE	P	
GS (A	Execution of test printing	S	
GS I	Sending the printer ID	S･P	
GS P	Specifying the basic calculation pitch	S･P	

Notes:

- In the Mode column: S = STANDARD MODE, P = PAGE MODE.
- ○ = shows the command affected by GS P.

9. CHARACTER CODE TABLE

9.1 Code Page

9.1.1 Codepage 00H to 7FH & PC437 (USA, Europe Standard)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	Ç	É	á	░	└	╨	α	≡
1		XON	!	1	A	Q	a	q	ü	æ	í	▒	┴	╤	β	±
2			″	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≧
3		XOFF	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≦
4	EOT	DC4	$	4	D	T	d	t	ä	ö	ñ	┤	─	╘	Σ	⌠
5	ENQ		%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6			&	6	F	V	f	v	å	û	ª	╢	╞	╓	µ	÷
7			’	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
8		CAN	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	HT		)	9	I	Y	i	y	ë	Ö	⌐	╣	╔	┘	θ	∙
A	LF		*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B		ESC	+	;	K	[	k	{	ï	¢	½	╗	╦	█	δ	√
C	FF	FS	,	<	L	¥	l	|	î	£	¼	╝	╠	▄	∞	^{n}
D	CR	GS	–	=	M	]	m	}	ì	¥	¡	╜	═	▌	ϕ	^{2}
E		RS	.	>	N	^	n	~	Ä	Pt	«	╛	╬	▐	∈	■
F			/	?	O	_	o	·	Å	ƒ	»	┐	╧	▀	∩	

Note: Kanji code table shows the shape of characters but does not show actual print result.

9.1.2 Codepage 00H to 7FH & Katakana

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	▁	┴	SP	ー	タ	ミ	═	×
1		XON	!	1	A	Q	a	q	▂	┬	。	ア	チ	ム	╞	円
2			″	2	B	R	b	r	▃	┤	「	イ	ツ	メ	╪	年
3		XOFF	#	3	C	S	c	s	▄	├	」	ウ	テ	モ	╡	月
4	EOT	DC4	$	4	D	T	d	t	▅	─	、	エ	ト	ヤ	◢	日
5	ENQ		%	5	E	U	e	u	▆	━	・	オ	ナ	ユ	◣	時
6			&	6	F	V	f	v	▇	│	ヲ	カ	ニ	ヨ	◥	分
7			’	7	G	W	g	w	█	▕	ァ	キ	ヌ	ラ	◤	秒
8		CAN	(	8	H	X	h	x	▏	┌	ィ	ク	ネ	リ	♠	〒
9	HT		)	9	I	Y	i	y	▎	┐	ゥ	ケ	ノ	ル	♥	市
A	LF		*	:	J	Z	j	z	▍	└	ェ	コ	ハ	レ	♦	区
B		ESC	+	;	K	[	k	{	▌	┘	ォ	サ	ヒ	ロ	♣	町
C	FF	FS	,	<	L	¥	l	|	▋	╭	ャ	シ	フ	ワ	●	村
D	CR	GS	–	=	M	]	m	}	▊	╮	ュ	ス	ヘ	ン	○	人
E		RS	.	>	N	^	n	~	▉	╰	ョ	セ	ホ	゛	╱	▒
F			/	?	O	_	o	·	┼	╯	ッ	ソ	マ	゜	╲	SP

9.1.3 Codepage 00H to 7FH & PC850/858 (Multilingual)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	Ç	É	á	░	└	ð	Ó	—
1		XON	!	1	A	Q	a	q	ü	æ	í	▒	┴	Đ	ß	±
2			"	2	B	R	b	r	é	Æ	ó	▓	┬	Ê	Ô	‗
3		XOFF	#	3	C	S	c	s	â	ô	ú	│	├	Ë	Ò	¾
4	EOT	DC4	$	4	D	T	d	t	ä	ö	ñ	┤	─	È	õ	¶
5	ENQ		%	5	E	U	e	u	à	ò	Ñ	Á	┼	€	Õ	§
6			&	6	F	V	f	v	å	û	ª	Â	ã	Í	µ	÷
7			'	7	G	W	g	w	ç	ù	º	À	Ã	Î	þ	¸
8		CAN	(	8	H	X	h	x	ê	ÿ	¿	©	╚	Ï	Þ	°
9	HT		)	9	I	Y	i	y	ë	Ö	®	╣	╔	┘	Ú	¨
A	LF		*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Û	·
B		ESC	+	;	K	[	k	{	ï	ø	½	╗	╦	█	Ù	¹
C	FF	FS	,	<	L	¥	l	|	î	£	¼	╝	╠	▄	ý	³
D	CR	GS	-	=	M	]	m	}	ì	Ø	¡	¢	═	¦	Ý	²
E		RS	.	>	N	^	n	~	Ä	×	«	¥	╬	Ì	¯	■
F			/	?	O	_	o	·	Å	ƒ	»	┐	¤	▀	´	

9.1.4 Codepage 00H to 7FH & PC860 (Portuguese)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	Ç	É	á	░	└	╨	α	≡
1		XON	!	1	A	Q	a	q	ü	À	í	▒	┴	╤	β	±
2			"	2	B	R	b	r	é	È	ó	▓	┬	╥	Γ	≧
3		XOFF	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≦
4	EOT	DC4	$	4	D	T	d	t	ã	õ	ñ	┤	─	╘	Σ	⌠
5	ENQ		%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6			&	6	F	V	f	v	Á	Ú	ª	╢	╞	╓	µ	÷
7			'	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
8		CAN	(	8	H	X	h	x	ê	Ì	¿	╕	╚	╪	Φ	°
9	HT		)	9	I	Y	i	y	Ê	Õ	Ò	╣	╔	┘	θ	
A	LF		*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B		ESC	+	;	K	[	k	{	Í	¢	½	╗	╦	█	δ	√
C	FF	FS	,	<	L	¥	l	|	ô	£	¼	╝	╠	▄	∞	^{n}
D	CR	GS	-	=	M	]	m	}	ì	Ù	¡	╜	═	▌	∅	^{2}
E		RS	.	>	N	^	n	~	Ã	Pt	«	╛	╬	▐	∈	■
F			/	?	O	_	o	·	Â	Ó	»	┐	╧	▀	∩	

9.1.5 Codepage 00H to 7FH & PC863 (Canadian-French)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	Ç	É	¦	░	└	╨	α	≡
1		XON	!	1	A	Q	a	q	ü	È	´	▒	┴	╤	β	±
2			″	2	B	R	b	r	é	Ê	ô	▓	┬	╥	Γ	≧
3		XOFF	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≦
4	EOT	DC4	$	4	D	T	d	t	Â	Ë	¨	┤	─	╘	Σ	⌠
5	ENQ		%	5	E	U	e	u	à	Ï	¸	╡	┼	╒	σ	⌡
6			&	6	F	V	f	v	¶	û	^{3}	╢	╞	╓	µ	÷
7			’	7	G	W	g	w	ç	ù	−	╖	╟	╫	τ	≈
8		CAN	(	8	H	X	h	x	ê	¤	Î	╕	╚	╪	Φ	∘
9	HT		)	9	I	Y	i	y	ë	Ô	⌐	╣	╔	┘	θ	
A	LF		*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B		ESC	+	;	K	[	k	{	ï	¢	½	╗	╦	█	δ	√
C	FF	FS	,	<	L	¥	l	|	î	£	¼	╝	╠	▄	∞	^{n}
D	CR	GS	−	=	M	]	m	}	=	Ù	¾	╜	═	▌	∅	^{2}
E		RS	.	>	N	^	n	~	À	Û	«	╛	╬	▐	∈	■
F			/	?	O	_	o	·	§	ƒ	»	┐	╧	▀	∩	

9.1.6 Codepage 00H to 7FH & PC865 (Nordic)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	Ç	É	á	░	└	╨	α	≡
1		XON	!	1	A	Q	a	q	ü	æ	í	▒	┴	╤	β	±
2			″	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≧
3		XOFF	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≦
4	EOT	DC4	$	4	D	T	d	t	ä	ö	ñ	┤	─	╘	Σ	⌠
5	ENQ		%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6			&	6	F	V	f	v	å	û	ª	╢	╞	╓	µ	÷
7			’	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
8		CAN	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	HT		)	9	I	Y	i	y	ë	Ö	⌐	╣	╔	┘	θ	
A	LF		*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B		ESC	+	;	K	[	k	{	ï	ø	½	╗	╦	█	δ	√
C	FF	FS	,	<	L	¥	l	|	î	£	¼	╝	╠	▄	∞	^{n}
D	CR	GS	–	=	M	]	m	}	ì	Ø	¡	╜	═	▌	∅	^{2}
E		RS	.	>	N	^	n	~	Ä	Pt	«	╛	╬	▐	∈	■
F			/	?	O	_	o	·	Å	ƒ	¤	┐	╧	▄	∩	

9.1.7 Codepage 00H to 7FH & PC852 (Eastern Europe)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	Ç	É	á	░	└	đ	Ó	–
1		XON	!	1	A	Q	a	q	ü	Ĺ	í	▒	┴	Đ	ß	”
2			″	2	B	R	b	r	é	ĺ	ó	▓	┬	Ď	Ô	˛
3		XOFF	#	3	C	S	c	s	â	ô	ú	│	├	Ë	Ń	ˇ
4	EOT	DC4	$	4	D	T	d	t	ä	ö	Ą	┤	─	ď	ń	˘
5	ENQ		%	5	E	U	e	u	ů	Ľ	ą	Á	┼	Ň	ň	§
6			&	6	F	V	f	v	ć	ľ	Ž	Â	Ă	Í	Š	÷
7			'	7	G	W	g	w	ç	Ś	ž	Ě	ă	Î	š	¸
8		CAN	(	8	H	X	h	x	ł	ś	Ę	Ş	╚	ě	Ŕ	°
9	HT		)	9	I	Y	i	y	ë	Ö	ę	╣	╔	┘	Ú	¨
A	LF		*	:	J	Z	j	z	Ő	Ü		║	╩	┌	ŕ	˙
B		ESC	+	;	K	[	k	{	ő	Ť	ź	╗	╦	█	Ű	ű
C	FF	FS	,	<	L	¥	l	|	î		Č	╝	╠	▄	ý	Ř
D	CR	GS	–	=	M	]	m	}	Ź	Ł	ş	Ż	═	Ţ	Ý	ř
E		RS	.	>	N	^	n	~	Ä	×	«	ż	╬	Ů	ţ	■
F			/	?	O	_	o	·	Ć	č	»	┐	¤	▀	´	

9.1.8 Codepage 00H to 7FH & PC866 (Russian)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	А	Р	а	░	└	╨	р	Ё
1		XON	!	1	A	Q	a	q	Б	С	б	▒	┴	╤	с	ё
2			″	2	B	R	b	r	В	Т	в	▓	┬	╥	т	Є
3		XOFF	#	3	C	S	c	s	Г	У	г	│	├	╙	у	є
4	EOT	DC4	$	4	D	T	d	t	Д	Ф	д	┤	─	╘	ф	Ї
5	ENQ		%	5	E	U	e	u	Е	Х	е	╡	┼	╒	ц	ї
6			&	6	F	V	f	v	Ж	Ц	ж	╢	╞	╓	ц	ў
7			’	7	G	W	g	w	З	Ч	з	╖	╟	╫	ч	
8		CAN	(	8	H	X	h	x	И	Ш	и	╕	╚	╪	х	°
9	HT		)	9	I	Y	i	y	Й	Щ	й	╣	╔	┘	ш	∙
A	LF		*	:	J	Z	j	z	К	Ъ	к	║	╩	┌	щ	·
B		ESC	+	;	K	[	k	{	Л	Ы	л	╗	╦	█	ъ	√
C	FF	FS	,	<	L	¥	l	|	М	Ь	м	╝	╠	▄	ы	No.
D	CR	GS	–	=	M	]	m	}	Н	Э	н	╜	═	Ţ	э	¤
E		RS	.	>	N	^	n	~	О	Ю	о	╛	╬	Ů	ю	■
F			/	?	O	_	o	·	П	Я	п	┐	╧	▀	я	

9.1.9 Codepage 00H to 7FH & PC857 (Turkish)

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
0	NUL	DLE		0	@	P	`	p	Ç	É	á	░	└	º	ó	—
1		XON	!	1	A	Q	a	q	ü	æ	í	▒	┴	ª	β	±
2			″	2	B	R	b	r	é	Æ	ó	▓	┬	Ê	ô	
3		XOFF	#	3	C	S	c	s	â	ô	ú	│	├	Ë	ò	¾
4	EOT	DC4	$	4	D	T	d	t	à	ö	ñ	┤	─	È	õ	¶
5	ENQ		%	5	E	U	e	u	ä	ò	Ñ	Á	┼		Õ	§
6			&	6	F	V	f	v	å	û	Ğ	Â	ã	Í	μ	÷
7			’	7	G	W	g	w	ç	ù	ğ	À	Ã	Î		¸
8		CAN	(	8	H	X	h	x	ê	İ	¿	©	╚	Ï	×	°
9	HT		)	9	I	Y	i	y	ë	Ö	®	╣	╔	┘	Ú	¨
A	LF		*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Û	.
B		ESC	+	;	K	[	k	{	ï	ø	½	╗	╦	█	Ù	¹
C	FF	FS	,	<	L	¥	l	|	î	£	¼	╝	╠	▄	Ì	³
D	CR	GS	–	=	M	]	m	}	ı	Ø	¡	¢	═	¦	ÿ	²
E		RS	.	>	N	^	n	~	Ä	Ş	«	¥	╬	Ì	–	■
F			/	?	O	_	o	·	Å	ş	»	┐	¤	▀	´	SP

9.1.10 Codepage 00H to 7FH & PC864 (Arabic)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	°	β	(RSP)	٠	¢	ﺫ	ـ	ﹽ
1		XON	!	1	A	Q	a	q	·	∞	(SHY)	١	ﺀ	ﺭ	ﻓ	ﹼ
2			"	2	B	R	b	r	∙	φ	ﺂ	٢	ﺁ	ﺯ	ﻗ	ﻥ
3		XOFF	#	3	C	S	c	s	√	±	£	٣	ﺃ	ﺳ	ﻛ	ﻩ
4	EOT	DC4	$	4	D	T	d	t	▒	½	¤	٤	ﺅ	ﺷ	ﻟ	ﻬ
5	ENQ		%	5	E	U	e	u	─	¼	ﺄ	٥	ﻊ	ﺻ	ﻣ	ﻰ
6			&	6	F	V	f	v	│	≈		٦	ﺋ	ﺿ	ﻧ	ﻲ
7			'	7	G	W	g	w	┼	«		٧	ﺍ	ﻁ	ﻫ	ﻐ
8		CAN	(	8	H	X	h	x	┤	»	ﺎ	٨	ﺑ	ﻅ	ﻭ	ﻕ
9	HT		)	9	I	Y	i	y	┬	ﻷ	ﺏ	٩	ﺓ	ﻋ	ﻯ	ﻵ
A	LF		*	:	J	Z	j	z	├	ﻸ	ﺕ	ﻑ	ﺗ	ﻏ	ﻳ	ﻶ
B		ESC	+	;	K	[	k	{	┴		ﺙ	؛	ﺛ	¦	ﺽ	ﻝ
C	FF	FS	,	<	L	\	l	|	┐		،	ﺱ	ﺟ	¬	ﻌ	ﻙ
D	CR	GS	-	=	M	]	m	}	┌	ﻻ	ﺝ	ﺵ	ﺣ	÷	ﻎ	ﻱ
E		RS	.	>	N	^	n	~	└	ﻼ	ﺡ	ﺹ	ﺧ	×	ﻍ	■
F			/	?	O	_	o		┘	[illegible]	ﺥ	؟	ﺩ	ﻉ	ﻡ	

9.1.11 Codepage 00H to 7FH & WPC1252

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	€			°	À	Ð	à	ð
1		XON	!	1	A	Q	a	q		‘	¡	±	Á	Ñ	á	ñ
2			″	2	B	R	b	r	‚	’	¢	²	Â	Ò	â	ò
3		XOFF	#	3	C	S	c	s	ƒ	“	£	³	Ã	Ó	ã	ó
4	EOT	DC4	$	4	D	T	d	t	„	”	¤	´	Ä	Ô	ä	Ô
5	ENQ		%	5	E	U	e	u	…	•	¥	µ	Å	Õ	å	Õ
6			&	6	F	V	f	v	†	-	¦	¶	Æ	Ö	æ	ö
7			’	7	G	W	g	w	‡	–	§	·	Ç	×	ç	÷
8		CAN	(	8	H	X	h	x	ˆ	˜	¨	¸	È	Ø	è	ø
9	HT		)	9	I	Y	i	y	‰	™	©	¹	É	Ù	é	ù
A	LF		*	:	J	Z	j	z	Š	š	ª	º	Ê	Ú	ê	ú
B		ESC	+	;	K	[	k	{	‹	›	«	»	Ë	Û	ë	û
C	FF	FS	,	<	L	¥	l	|	Œ	œ	¬	¼	Ì	Ü	ì	ü
D	CR	GS	–	=	M	]	m	}			–	½	Í	Ý	í	ý
E		RS	.	>	N	^	n	~	Ž	ž	®	¾	Î	Þ	î	þ
F			/	?	O	_	o	·		Ÿ	¯	¿	Ï	ß	ï	ÿ

9.1.12 Codepage 00H to 7FH & Thaicode18

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	DLE		0	@	P	`	p	┌	ฯ		ฐ	ภ	ะ	เ	๐
1		XON	!	1	A	Q	a	q	┐	๑	ก	ฑ	ม	ั	แ	๑
2			"	2	B	R	b	r	└	ั่	ข	ฒ	ย	า	โ	๒
3		XOFF	#	3	C	S	c	s	┘	ั้	ฃ	ณ	ร	ำ	ใ	๓
4	EOT	DC4	$	4	D	T	d	t	│	ั๊	ค	ด	ฤ	ิ	ไ	๔
5	ENQ		%	5	E	U	e	u	─	ั๋	ฅ	ต	ล	ี	ๅ	๕
6			&	6	F	V	f	v	├	ิ่	ฆ	ถ	ฦ	ึ	ๆ	๖
7			'	7	G	W	g	w	┤	ิ้	ง	ท	ว	ื	็	๗
8		CAN	(	8	H	X	h	x	┴	ิ๊	จ	ธ	ศ	ุ	่	๘
9	HT		)	9	I	Y	i	y	┬	ิ๋	ฉ	น	ษ	ู	้	๙
A	LF		*	:	J	Z	j	z	┼	ิ์	ช	บ	ส	ฺ	๊	๛
B		ESC	+	;	K	[	k	{	█	ี่	ซ	ป	ห	ื่	๋	ี่
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D	CR	GS	-	=	M	]	m	}	↑	ี๊	ญ	ฝ	อ	ื๊	ํ	ี๊
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9.2 International Character Code Table

<table>
<tr><th></th><th>Country</th><th>23</th><th>24</th><th>40</th><th>5B</th><th>5C</th><th>5D</th><th>5E</th><th>60</th><th>7B</th><th>7C</th><th>7D</th><th>7E</th></tr>
<tr><td>0</td><td>USA</td><td>#</td><td>$</td><td>@</td><td>[</td><td>\</td><td>]</td><td>^</td><td>'</td><td>{</td><td>|</td><td>}</td><td>~</td></tr>
<tr><td>1</td><td>France</td><td>#</td><td>$</td><td>à</td><td>°</td><td>ç</td><td>§</td><td>^</td><td>'</td><td>é</td><td>ù</td><td>È</td><td>¨</td></tr>
<tr><td>2</td><td>Germany</td><td>#</td><td>$</td><td>§</td><td>Ä</td><td>Ö</td><td>Ü</td><td>^</td><td>'</td><td>ä</td><td>ö</td><td>ü</td><td>β</td></tr>
<tr><td>3</td><td>UK</td><td>£</td><td>$</td><td>@</td><td>[</td><td>\</td><td>]</td><td>^</td><td>'</td><td>{</td><td>|</td><td>}</td><td>~</td></tr>
<tr><td>4</td><td>Denmark I</td><td>#</td><td>$</td><td>@</td><td>Æ</td><td>Ø</td><td>Å</td><td>^</td><td>'</td><td>æ</td><td>ø</td><td>å</td><td>~</td></tr>
<tr><td>5</td><td>Sweden</td><td>#</td><td>¤</td><td>É</td><td>Ä</td><td>Ö</td><td>Å</td><td>Ü</td><td>é</td><td>ä</td><td>ö</td><td>å</td><td>ü</td></tr>
<tr><td>6</td><td>Italy</td><td>#</td><td>$</td><td>@</td><td>°</td><td>\</td><td>é</td><td>^</td><td>ù</td><td>à</td><td>ò</td><td>è</td><td>ì</td></tr>
<tr><td>7</td><td>Spain I</td><td>Pt</td><td>$</td><td>@</td><td>¡</td><td>Ñ</td><td>¿</td><td>^</td><td>'</td><td>¨</td><td>ñ</td><td>}</td><td>~</td></tr>
<tr><td>8</td><td>Japan</td><td>#</td><td>$</td><td>@</td><td>[</td><td>¥</td><td>]</td><td>^</td><td>'</td><td>{</td><td>|</td><td>}</td><td>~</td></tr>
<tr><td>9</td><td>Norway</td><td>#</td><td>¤</td><td>É</td><td>Æ</td><td>Ø</td><td>Å</td><td>Ü</td><td>é</td><td>æ</td><td>ø</td><td>å</td><td>ü</td></tr>
<tr><td>10</td><td>Denmark II</td><td>#</td><td>$</td><td>É</td><td>Æ</td><td>Ø</td><td>Å</td><td>Ü</td><td>é</td><td>æ</td><td>ø</td><td>å</td><td>ü</td></tr>
<tr><td>11</td><td>Spain II</td><td>#</td><td>$</td><td>á</td><td>¡</td><td>Ñ</td><td>¿</td><td>é</td><td>'</td><td>ì</td><td>ñ</td><td>ó</td><td>ú</td></tr>
<tr><td>12</td><td>Latin America</td><td>#</td><td>$</td><td>á</td><td>¡</td><td>Ñ</td><td>¿</td><td>é</td><td>ü</td><td>ì</td><td>ñ</td><td>ó</td><td>ú</td></tr>
<tr><td>13</td><td>Korea</td><td>#</td><td>$</td><td>@</td><td>[</td><td>₩</td><td>]</td><td>^</td><td>'</td><td>{</td><td>|</td><td>}</td><td>~</td></tr>
</table>